SMALL LAKES AND RESERVOIRS IN THE HILLS OF SICILY. MAINTAIN, SAVE AND RECOVER RURAL LANDSCAPE.

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ABSTRACT

In the transition from nomadic to sedentary, people have tried - for their settlements - the most plenty of water, and the first cities were founded, in fact, along Tigris and Euphrates rivers, extraordinary water resources in a particular dry climate.
In the most interior of Sicily, which has always been characterized by low rainfall, the farmers - over time - have tried various expedients for the preservation of rain water in order to allow its survival and crop.
The use of new technologies and materials has resulted in recently hard impacts for landscape, while construction of small dams filled with earth, using natural soil impluviums and the nature of the land, made it possible to irrigate thousands of hectares of agricultural land otherwise ready for drought. A "sustainable" technique, which resulted in the last sixty years, a significant change in the rural landscape of Sicily.
In a time when the whole country seems to be threatened - to build indiscriminately - by excessive consumption of soil, which will inevitably and irreversibly alter the environmental balance, the rediscovery of the landscape value of crops that characterize - today - the sicilian countryside and techniques of sustainable conservation of rainwater, it seems of great relevance for the study and protection of soil and for the recovery of the identity of this territory.
This abstract introduce to a multidisciplinary investigation yet started, which will aim to assess both technical and landscaping aspects, both economic and agronomic, and also ecological profiles of this technique to protect the biodiversity in these specialized fields. The investigation will aim also to give an historical perspective and an ex-post evaluation of interventions in order to lead to urban planning, landscape and spatial awareness. A further aim is the design of a network system which has impacts on the quality of rural tourism, which emphasizes, as an example, the interaction with the system of bicycle routes and footpaths, greenways, that is being developed in Sicily.

keywords
Rural landscape,
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lakes,
sustainability,
landscape ecology,
biodiversity,
water,
drowght

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1 | Research proposal

The proposed research project concerns landscape architecture, hydraulic engineering, agricultural, natural and biological sciences, and it deploys developing multidisciplinary contributions. This research will also include issues relating to the concept of the 'territory' from the viewpoint of a sustainable use by tourists, and the protection of the landscape and biodiversity. This use by tourists and the protection of the landscape will take into account a desired equilibrium between these two apparent contradictions.

The idea of developing hillside lakes in Sicily originated from the development of new techniques of cultivation on the back of the modernising industrialization, which took place in agriculture after the Second World War. It aimed at offering farmers enhanced water resources which would facilitate the implementation of experimental projects and obtaining hitherto impossible yields.

The climatic conditions of the region of Sicily, combined with predominantly arid soils (whose degree of humidity was difficult to maintain in the dry season) has always rendered the cultivation of various plants difficult in the spring/summer period. Moreover, precipitation tails off sharply with the arrival of this period. For example, an increase in the cultivation of vines which has significantly changed the hilly Sicilian landscape in recent years, together with a considerable increase in land under cultivation, has increased the demand for resources, particularly in extended periods of drought.

Recent studies relating to global climate change have demonstrated that the need for irrigation increases exponentially with an increase in temperature and reduced rainfall, the result of which is an increase in the rate of evaporation. In a similar manner, greater variation in rainfall produces a variation in the rate of evapo-transpiration, which in turn is reflected in extended periods of drought. In the absence of the compensating action of irrigation, this increase in temperature has a negative impact on agricultural produce and the quality of this produce in terms of flavour and taste.

Furthermore, the impact of increasing desertification should be taken into account and, for this reason, Italy is a Member of the 1997 UN programme, which mandated a National Action Plan in addition to the implementation of the UN Convention on Climate Change. Indeed, ENEA studies have identified the Sicilian provinces of Enna, Caltanissetta and Catania as areas which are susceptible to desertification due to their high level of erosion. Various detailed studies were also performed in the province of Agrigento in 2000-2003, particularly around the town of Licata.

In light of these considerations, this research group would like to research a number of issues: i) the data required to assess the suitability of locating new water resources by means of hill lakes with environmentally-friendly constructed drainage basins; ii) the potential associated with protecting habitats surrounding pre-existing lakes, thereby guaranteeing the biodiversity which these water resources would enhance; and iii) the identification and promotion of potential links between the locations of these drainage basins and the network of pathways (for cyclists, horse-riders etc), a project which in Sicily is still in the planning stages.

2 | Rural town planning

Agricultural, hydraulic engineering and economics texts of the mid-nineteenth century in Italy, reveal a gloomy picture describing a marked economic and social north-south divide, characterised by elevated degrees of depopulation in the interior to the detriment of the coastal areas, generally related to the broader problem of the south. Whilst still topical, this issue presumably requires long-term planning which takes into account the true potential of southern Italy, also linking this to its agricultural characteristics.

The "apparent antithesis which exists in the expression Rural Town Planning" (Chiodi, 1938), and later used by Toccolini (1987), is still today the title of one of the courses in the various Agriculture faculties in Italian universities. Chiodi stated that this antithesis deals with "precision": town planning, conceived as a science describing the territory, should deal with the discipline of agriculture as an economic activity and as environmental protection.

Relationships between agricultural matters, and town and regional planning have certainly improved throughout these seventy years but the lack of a multidisciplinary dialogue persists and its effects are evident. The physical characteristics of one area are insufficient for determining project choices, in addition to the economic and social trends which must be faced, together with the environmental constraints of the same area (Toccolini, 1987). It is thus necessary to define new paradigms for urban development where the urban dimension must be surpassed by seeking an equilibrium between human settlements, and the forms and forces of nature. This would commence with the geography of areas of study and spaces with which to rebuild relationships which contribute to improving knowledge in this field and developing future processes of collective identification. Thus, principles of multi-purpose could be promoted in an agricultural landscape, as recently proposed by the European Union.

3 | Small hillside lakes throughout recent history

It is from the aforementioned viewpoint that research regarding the effects of applying a particular approach is proposed. This research has probably contributed to creating the conditions for an economic revival in several parts of the interior in Sicily. At a distance of approximately fifty years from the completion of the first hillside lake

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in Sicily, the proposed research will attempt to sketch an equilibrium by evaluating how the improved irrigation of the land has enabled cultivation, the differentiation of crops, the raising of livestock, whilst contemporaneously contributing to the protection of a rural landscape and physical culture.

In the remotest parts of the Sicilian interior, which are characterized by low precipitation, farmers have always attempted to conserve water by the simple means of diverting or saving rainwater. Various scholars have argued that private water management consortia already existed starting from the eleventh century (Cisca, 1928) and that the local authorities permitted them to divert waters from rivers for the promotion of agriculture and industry. In Sicily, where the effects of climate change caused by excessive deforestation began to be felt, the oldest dam, constructed in1563 in Contrada Grotticelli by the Duchy of Terranova (present-day Gela in the Province of Caltanissetta) is still to be found. However, it was necessary to wait until the early twentieth century for the matter of water conservation to be subjected to technical expertise and commented upon by John Bellincioni, based on various experiments performed in America (Fairmount Park).

Further improvements in the field of water conservation were made after World War II when the development of building techniques led to a reduction in costs. Indeed, the immediate problem to tackle in the new-born Italian state was that of agriculture, especially in a region such as Sicily where workers in the primary sector accounted for 63% of the workforce. In 1950 the establishment of the Fund for the South, which sought to promote economic development in depressed areas, enabled the construction of schools, waterworks, sewers, and various public works. This was performed by means of utilising its resources with the aim of improving the quality of life and reducing the phenomenon of emigration. In this context, policies were introduced with the aim of mitigating the devastating effects on the economy of the island both regarding climate and rainfall (the latter regarding a period of one or two months and intensity). It was then thought that the technique of hillside lakes would be crucial in maintaining water levels, so much so that individual companies could receive grants for their construction.

The subsequent abandonment of the use of hillside lakes to save water was tied to the development of other sectors in the economy, but also to the fact that the Italian state, initially an agent and backer of this project, later changed the funding criteria. In 1965 its contribution was greatly reduced, only recognizing farms located at the lower reaches of hillsides, excluding inland areas, and terminating the practice of encouraging large and expensive public works, drawn out over time with a high environmental impact. What have been the consequences of these policies? Particularly, what were the results of that policy which introduced hillside lakes into Sicily, the policy which became widespread throughout the south and which has subsequently led to its abandonment? Excluding the effects in the economic and social spheres, albeit relevant, the significant effects of hillside lakes on the agricultural landscape will now be discussed.

4 | Small dams for small reservoirs for combatting drought

Given that the recent decline in precipitation in several southern regions has resulted in a precarious water supply and that this phenomenon affects not only the regions traditionally affected by drought but also regions like Campania, Basilicata, Molise, it was observed that such periods of drought in Sicily further worsened long-standing problems of the water supply. Thus, we consider it fundamental in this research project to identify possible strategies for dealing with this challenge.

The distinction between small and large dams is by convention based on the height and volume of the dam. The Regulations relating to dams, that is, DPR 1363/59, updated by the Ministerial Decree of 24 March 1982, is applicable to dams whose height exceeds 10 m or whose volume is greater than 100,000 m^3. According to these criteria, most authors currently agree that we can typically define 'small dams' as those whose height is less than 15 m with and a reservoir volume of less than or equal to 1,000,000 m^3 (L 584 / 94). Data relating to such 'small' dams is, however, lacking, particularly regarding their quantity and the institutions with the skills required to manage the dams. The census of hillside lakes (Crivellari, 1984), updated in 1978, identified 8,400 dams (approximately 85% of those were constructed as a result of incentives from the Ministero Agricoltura e Forest") with an estimated volume of approximately 225 million m^3. The number of small reservoirs is continually being updated by the Ministry of Agriculture and Forestry, notwithstanding the difficulties due to varying definitions, criteria used in determining the limits of reference relating to size, and intended use; there currently exists no complete register.

The possibility of constructing hillside lakes depends very much on precise and specific technical aspects, such as the presence of particular geomorphological features attributed to impermeable soils or whether or not the lake can be fed by springs, wells and/or a catchment area of sufficient water volume, or a mixture of these systems. The construction of hillside lakes involves the accumulation of rainwater with which to intercept the flow of surface water along the length of the catchment area by a barrier consisting of a small earth dam. The edges of the surface of the reservoir are protected by trees, thus preventing runoff and reducing evapo-transpiration. From a planimetric point of view, the appearance of a lake (excluding the side of the dam) generally assumes a homogeneous and irregular nature, which can be linked to the morphology of the site.

This method of accumulation could still today comprise an effective means against drought due to: i) the hilly area of Sicily being approximately 61.4% (that is, excluding the

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coastal plains, Mount Etna, the Nebrodi and Madonie mountains, nearly covering the whole island); and ii),the clayey nature of the soils which obviates the necessity to line the bottom of the reservoir, thereby reducing costs and minimising environmental impact.
Of the probable proven benefits, the practice of constructing hillside lakes has a lowered impact on the environment, unlike with the use of massive, above-ground tanks. These so-called large tanks are often made of reinforced concrete, which modify the agricultural landscape by their marked environmental and landscape impact, necessitating a water supply from wells or other reliable sources. Whilst the practice of constructing hillside lakes is not strictly sustainable (in that it is not easily reversible), it does, however, benefit the cultural, economic culture of fauna and flora so as to offset the impact of the lake. The practice is certainly insignificant compared to the impact of large dams which may alter the microclimate of the area due to the large surface area involved and substantial disposal of solid material downstream.

5 | Transforming the country landscape

Whilst it is evident that human intervention has produced and continues to produce changes in the environment and significantly affect ecosystem equilbria, it can be noted that in addition to a negative impact, human intervention can foster a rebalancing of various natural or semi-natural systems (for example, the policy of reforestation, which, if applied appropriately, maintains forest ecological systems at an optimum level). Agriculture in Italy is an example of a fundamentally human activity, concerning 50% of the 30 million hectares of land (of the total national territory, 87% is fortunately still farmland, forest and areas of natural beauty). By means of appropriate soil management, human activity encourages a general ecosystem balance by direct crop management and a marked interdependence of various organizational factors relating to agricultural systems with the surrounding ecosystem, despite the high risk of the pollution of lakes and ponds.
The country landscape, therefore, forms a fundamental connection between human activity and environmental systems, in which the human capacity to bring influence to the land can be expressed in different ways. However, these ways are based on the need to obtain a balance with the environmental conditions in which man lives. It was not by chance that the Cork Declaration (emanating from the European Union, promulgated during the meeting held in Ireland in 1996 and which introduced the definition of the countryside) began to exploit the potential of rural areas. Prior to and by means of Leader Projects, this Declaration aimed at protecting the values and production factors which were directly or indirectly tied up with the countryside. The Declaration's objective was to promote and revitalize the culture of rural areas, under severe threat of urban and industrial blight, and the abandonment of the countryside and socio-economic degradation. Below are various case studies regarding lakes and different methods of water conservation, using different construction techniques for varying purposes and with different effects.

5.1 | Baiata Lake (author Manfredi Leone)

In the Trapani plain land, between the small hills called "Timponi", a large artificial reservoir was created, "Lake Baiata "; the small lake is in the municipality of Paceco, a seventeenth-century town built on the foundation of a slight rise overlooking towards the seashore and the system of Saline (sea salt plants).
The watersheds of the territory of Paceco are the Lenzi-Baiata, the Birgi and Verderame. Torrent Baiata originates at an altitude of 191 m, in the higher Dattilo. It is long about 23 Km, and for 4 or 5 of its path it is the boundary line between Paceco and Trapani. It flows into the Mediterranean Sea, between the pans of Trapani's families named Savona and Calcara. The last part of this torrent, about 4 km, is called the Canal Baiata. It follows, after the confluence with the Canal Xitta just south, the natural bed of the same stream.
Torrent Birgi enters the territory of Paceco at an altitude of 82 meters with the name of River Fittosi. Along the followings 7 Km, at the 61 m. altitude, remains as administrative boundary between Paceco and Trapani. From the altitude of 74 meters on the sea level, it is called the river Bordino. In this confluence of three rivers of the same name from all the slopes of the Costiera Siggiare, the river takes name of Birgi, up to its mouth. The basin of the stream Verderame occupies the lower part of the surface. The stream, which in the first part is also known as Torrent Quasarano, was born in the coast, it has two separate arms that come together at altitude 59 meters on the sea level. Receives no tributaries. The system of all these streams and torrents consists in flow almost absent during spring and summer while during autumn and winter are high flows, which often result in damaging floods.
This happens because rainfalls which are distributed unevenly, the geological nature of the streams, the conformation of the beds (or stray or section of water insufficient to fully dispose of). In 1977 the Consortium of Birgi was created, a new public authority charged to contain the devastating floods of the rivers Lenzi Baiata, use their water for irrigation in dry periods; the consortium built a dam on the stream Baiata, in the east of the town of Paceco , at Via Sapone. The center of the artificial lake includes the entire area of the reservoir Contrada Costa di Rame, whose margins are the proportion considered normal for the lake water level. The extension of the reservoir continues, as the level of flood detention normal to via Sapone and Contrada Baronazzo whose margins are the limits at maximum water level. That dam was completed in the '80s, but so far, as evidenced by the Italian Register of Dams, is not eligible for the maximum flow and is considered (after thirty years) an experimental dam; was credited with a maximum volume of 5 million cubic meters against 6,7 that the lake could contain.

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The building of the reservoir has changed some ancient tracks; a new eucalyptus forest grew on the banks of the reservoir, outlined as a natural resource in the urban master plan. These areas of special environmental value need to be protected to safeguard the integrity of the places and wildlife. In these areas is prohibited any construction of new buildings and no chang of the existing land use is allowed.

Since the '80s the local community start to discuss a possible suburban park surrounding the lake, for use it as an attractor of a portion of the province of Trapani, which has a very beautiful scenic resources (the tower on the coast of Nubia, the salt), but that does not stand up to the present confrontation with competitors highly rated as the same saline plants, Mothia Island and the Lagoon, the medieval town of Erice and the Egadi.

Among many difficulties and rebounds in government, in anticipation of the passage of the tormented land ownership by the national land policy, in 2005 the City of Paceco, based on the new Master Plan design and ideas, has launched a design competition to develop the Suburban Park. The competition, regularly hesitated, should have formed a preliminary project for financial support UE and regional resources called POR 2007-2013, but now everything has stopped. The scarcity of affirmative action has instead left the field to negative actions, not even five years ago have been identified and seized the edge of the lake four abusive animal shelters with approximately 1,500 sheeps, whereas between the eucalyptus trees on the banks, gathered illegal landfills of municipal solid waste. From the perspective of the urban landscape the lake Baiata would be a great opportunity for the city of Paceco, both as a green urban equipment and as a place to propose new services to tourism such as fishing or sailing. It is hoped that the municipality will be able to find resources to acquire and manage these assets, and with the shaft downstream river could be a great linear park land from the hills to the sea.

5.2 Marchesa lake (author Valeria Scavone)

In the north-west hills of Sicily, within the wide boundaries of the town of Monreale, an age-old farm (identified in the Land Registry as Figures 142-159) covers a total area of 334 hectares, at a height of between 200 and 340 meters above sea level. It can be easily reached via the main road leading to Camporeale (distant about 10 km) or via the A19 motorway (distant approximately 8 chilometries). Prior to the implementation of water projects for irrigation, the farm was almost entirely given over to arable land, pasture, with a very small area (26 hectares) used as vineyards; the latter was to the detriment of agricultural production.

The construction of the reservoirs occurred in two phases: in 1974, a small experimental lake of 20,000 cubic meters was built, at a height of 7 meters with a small barrier. Thereafter, between 1977 and 1978, the principal reservoir of 500,000 m^2 plus irrigation system were finalised. A small tributary of the St Bartholomeo river flowed into the 17 m-high dam. After the construction of the reservoir on the Marchesa farm, vineyards were planted over an area of approximately 200 hectares, which have proved over the years to be particularly productive. Following this positive effect on the crops in this area, neighbouring downstream farms subsequently constructed a further 2 hillside lakes, making a total of about 160,000 m^3.

The countryside in this part of Sicily is also characterized by very intense rainfall and often affected by storms which are extremely damaging to crops, even if the rainfall is limited to two months of the year, alternating with prolonged periods of drought. This situation, coupled with the typical Mediterranean climate of very high summer temperatures, has led to there being insufficient water for irrigation, occasionally to the point where planting was not possible. The main achievement of the Marchesa lake, nestling in the gently-sloping, surrounding hills, has been - instead - the planting of large quantities of vineyards, optimising the farm's production level and characterizing the surrounding countryside.

The drainage basin of the San Bartolomeo river (approximately 425 km^2 and ranked 13th in size as regards significant bodies of water) is situated between the provinces of Palermo and Trapani. The river springs up around Calatafimi and is known as "fiume Freddo". It flows for 50.26 km and, after joining "fiume Caldo", it flows into the sea near the beach at Castellammare del Golfo on the northern coast of Sicily. Specifically, the San Bartolomeo river has been defined in the Sicilian Water Conservation Plan (Piano di Tutale delle Acque) as one of the few rivers, in Trapani, with significant discharge. The entire basin covers an area of 42,501 hectares, of which 36,951 are for agricultural use (the so-called Superficie Agraria Utilizzata or SAU). However, of this latter statistic, only 7,600 hectares are irrigated by major water resources, the remaining land receiving water from private sources.

5.3 | A lake intervention "ante litteram" Maredolce (author Gaetano Brucoli)

A pioneering example regarding hilly lakes, like they are now designed and particularly suited to its characteristics previously mentioned, is given from the so-called Maredolce Lake, formerly located in the south-east countryside of the Palermo's plain and that is now largely dried up and buried.

The most interesting aspect of this artifact is that it was built during the Norman rule of Sicily and, in particular, by the initiative of Roger II between 1130 and 1154, as was reported by Bishop Romuald, the Salernian. Benjamin of Tuleda who described it in 1172, named it as Albehira (from Buhayra), whose literal meaning is "little sea" and with whom they were given the broad river used for irrigation.

The lake was built at a site that, as a result of the intrinsic geological condition, already before human intervention, must have been demarcated for a natural form of water collection, probably a small marshy depression. The ground on which fell was

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in fact composed of a layer of clay (Numidian Flysch) outcrops on which flowed and was deposited the abundant flow of water arising from the limestone near the calcareous bedrock of Mount Grifone.
The principal Human interventions had concerned in a deepening of the bottom and in the building of a dam with a thick approximately of fifteen meters on the downstream; the dam consists of land to carry from the excavation depth, lined on the upstream side by a wall built in large blocks of limestone and was plastered by a layer of hydraulic plaster (earthenware), as well as the lake bottom, in order to improve its ability to sealing.
The lake was devoid of its own catchment area, which shall fill and its water supply was largely provided by onlyone Spring (Fawara in Arabic) of Maredolce that had an historical water flux around 68.24 l/sec. (8 picks) in 1419 (Bresc), and 69 l/sec. in 1930 (Ministero Lavori Pubblici); it flows from the bedrock of Mount Grifone at a height of 35 meters above sea level, in correspondence with Pizzo Sferrovecchio and near both the eighteenth-century church of St. Cyrus and the point where is today's beginning of the Palermo-Messina highway.
The lake had an approximate total area estimated at around 110,000 sq.m., but part of the basin was occupied by an island of just over 20,000 square meters, so its reale liquid surface should be slightly above the 85,000 square meters, equivalent to a volume of water that was developed for about 215,750 cubic meters, referring to a hypothetical depth of about 2.5 meters.
Located at an altitude above sea level relatively low (between 26 and 30 meters), Lake Maredolce was pratiucally a plain lake like other lakes, situated below 100 meters asl, and made between the 50s and 60s of the XX century in the provinces of Agrigento and Trapani.
How even tell the historical sources, the principal purpose of the lake was related to the leisure activities of the Norman kings (it was possible to cross by little boat and there were also been introduced varied species of fish), but beside them it maintained an high importance for the irrigation, as was evidenced by the nine canalizzations that irrigated the surrounding agricultural land.

6 | Effects on the environment, soil and the economy

With suitable planning (particularly regarding the hydrology), the creation of a hillside lake can confer considerable benefits to a particular catchment area and its surroundings, starting with the productive capacity of the surrounding land. Excluding the evident benefits to crops, a hillside reservoir implies numerous positive factors. The function of a fire-break is one of the most important (as testified in the current literature) but, in terms of hydrology and land use, the retention of surface water and run-off control should not be neglected, the absence of which may, in conjunction with significant precipitation, cause considerable damage to people and/or property.
From a landscape point of view, the inclusion of a lake can have a minimum impact, particularly when built deploying low-impact construction techniques, paying attention to the location of the basin and surrounding natural forms. As regards the biotic system, the presence of a reservoir certainly protects biodiversity, as such a vibrant ecosystem hosts various species of animal and plants whilst not totally excluding recreational and tourist uses. Moreover, the guarantee of an increased water supply facilitates the planting of vegetables and orchards on arid and less than hospitable soils.
Regarding conflicts of interests, which can make the use of this type of multi-functional lake very difficult, we can recall, for example, the case of reservoirs whose main purpose is to supply drinking water: they require such a level of protection from pollution that any tourist-related use may be impossible. The creation of small lakes within a region characterized by marked variations in weather from the dry to rainy season can enhance environmental features (and this should be demonstrated by research). An example of these features is the diffusion of specific plant and wildlife habitats, which require conditions of elevated humidity provided by bodies of water (for amphibians, especially migratory birds, etc.). This intervention can have extremely important ecological consequences, again as demonstrated by research, even bearing in mind a possible decrease in water flow and related challenges.
As previously mentioned and from an economic point of view, the presence of a hillside lake will have an immediate effect on agricultural productivity. Various databases have clearly demonstrated increases in productivity as a function of greater agricultural capacity, and increases in company turnover as more valuable crops can be planted. Increased agricultural productivity could also lead to an increased investment in the revitalization of country towns and villages.
A further spin-off of constructing hillside lakes is the potential for eco-tourism. The most pressing challenge for many years in most Mediterranean countries has been the necessity of initiating innovative activities with suitable levels of productivity, especially in inland, hilly and mountainous regions. Tourism is one possible way by which to resolve this challenge, albeit not without risk: the first and most preponderant is that the development of tourism could damage the natural environment and landscape. For example, in Tuscany, a model region of the land-countryside balance for centuries, farmers' associations have been established and Tuscany now welcomes many tourists whose visits do little or no damage to the environment. Returning to Sicily, paths or horse trails along the banks of lakes could be provided as well as fishing facilities and the purchase of local products. Such a policy has long been adopted in France, providing, for example, tourist products such as wine and milk routes. This is in addition to other similar initiatives undertaken in maintaining rural areas in the Mediterranean, which are

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currently experiencing great economic and social challenges.

7 | The planning of water resources

There currently exists in Sicily the Water Protection Plan (Piano di Tutela delle Acque) of December 2007 which deals with the analysis of the quality of various important water sources: surface water, groundwater and coastal marine waters. The Water Protection Plan specifies the measures to be taken in protecting and improving the quality standards of these waters

The General Regulatory Plan for Supplying Water (Piano Regolatore Generale degli Acquedotti), updated in 2006, deals with specifying which water resources can be used for domestic purposes and identifying further sources. The Plan also specifies the resource/requirement ratio. The activities of the Integrated Water Services (SII) are assigned to nine Authorities (Autorità d'Ambito Ottimale or ATO), whose sphere covers that of the Province, and it provides water for domestic use. The Regional Waste and Water Agency (Agenzia Regionale dei Rifiuti e delle Acque or ARRA), established by LR no.19 of 22/12/05, has amongst other responsibilities, the management of major infrastructure for irrigation (ie, dams and major pipe irrigation complexes), while the eleven Bonifica consortia (9 provinces, excluding Gela and Calatagirone) only deal with smaller irrigation networks, thus favouring the private companies of the consortia.

From this complex regulatory and institutional framework we can deduce, firstly, a divide between water for domestic and irrigation uses and, secondly, the fact that small private reservoirs(the topic of this paper) are currently not taken into consideration at all, and this has not insignificant effects on improving irrigated land. The awareness that water resources must be managed for multiple uses in an integrated way exists in all advanced countries, whether they comprise surface water, groundwater and waste-water; each should not be considered as a separate entity and their conservation must be compatible with soil conservation environmental protection.

In this regard, the recent Piano di Sviluppo Rurale Sicilia of 2007-2013, nn.214 and 216, makes explicit reference to the fact that we must combat in every way possible and limit the processes of desertification, and an important role must be assigned to the management of "integrated and sustainable water resources". The following require particular attention: the screening and quantitative and qualitative conservation of water resources, the containment of waste, the effective maintenance and regulation of water plants, appropriate and efficient technical and administrative management, the implementation of a plan for distributing water resources to the various consumers, also avoiding conflicts of interest. The basic premise of this document, shared by its authors, is that development – intended as progress – plays a fundamental role with water.

This apparent increasing interest in integrated management and sustainable water resources and preventative actions, which constitute a policy of protection, highlight the relevance of the proposed research, as outlined in this paper. It will, thus, be useful to assess whether, rather than constructing large bodies of water, would it be more appropriate to build hillside lakes. Doing so would confer the benefits of an enhanced water supply, in addition to fulfilling a fire-break function by using rainwater at source without exploiting valuable resources, such as drinking water (sometimes used for filling vasconi (large water containers). Other benefits of hillside lakes would be the irrigation of specialised crops, sustainable tourism and fish farming. If these were encouraged in urban-forested areas, the lakes would play a defensive role as regards urban centres by functioning as fire-breaks; if they were planned sympathetically, they could be constructed in harmony with the landscape, integrating into the landscape over time. The research outlined in this Paper will aim at assessing the survival and promotion of hillside lakes, thus contributing to the development of the land, given that farming areas are the bearers of historical value and cultural identity (Magnaghi, 1998).

8 | Conclusion

The areas in Italy considered at risk of desertification are located in the southern part of the peninsula and islands. This phenomenon certainly constitutes an environmental emergency, so much so as to affect the socio-economic development of these regions. As a part of this process, the deterioration of water resources is an indicator of the phenomenon, interpreted as the degradation of the landscape and the productive system of the area. The management of water resources, in environments periodically subject to drought – such as those in Sicily - requires a multidisciplinary and integrated approach. The productive activities of man in the countryside must converge with environmental, social, economic town planning, architectural, historical and cultural values.

Within the perspective of an environmental policy of preserving, protecting and improving the quality and sustainable use of water resources, the aims of the research, proposed in these pages, are to study the possible promotion of a particular accumulative practice at the expense of others, which are deemed to be less environmentally sustainable and with greater impact in terms of the landscape. Environmental, territorial and landscape policies, integrated with those economic and industrial could encourage Sicily to be competitive. Such a result would be brought about by combining the protection and enhancement of natural resources, the preservation of the landscape and rural development, thereby limiting the inappropriate use of lands which would lead to an irreversible alienation from the land.

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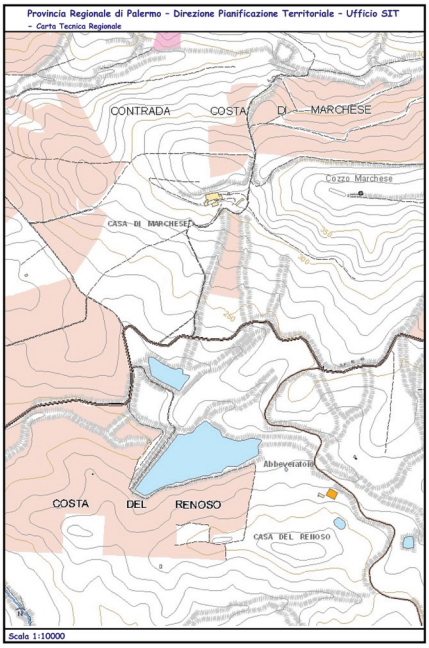

Figure 1. Regional map where can you find the two hills lakes, Marchese countryside.

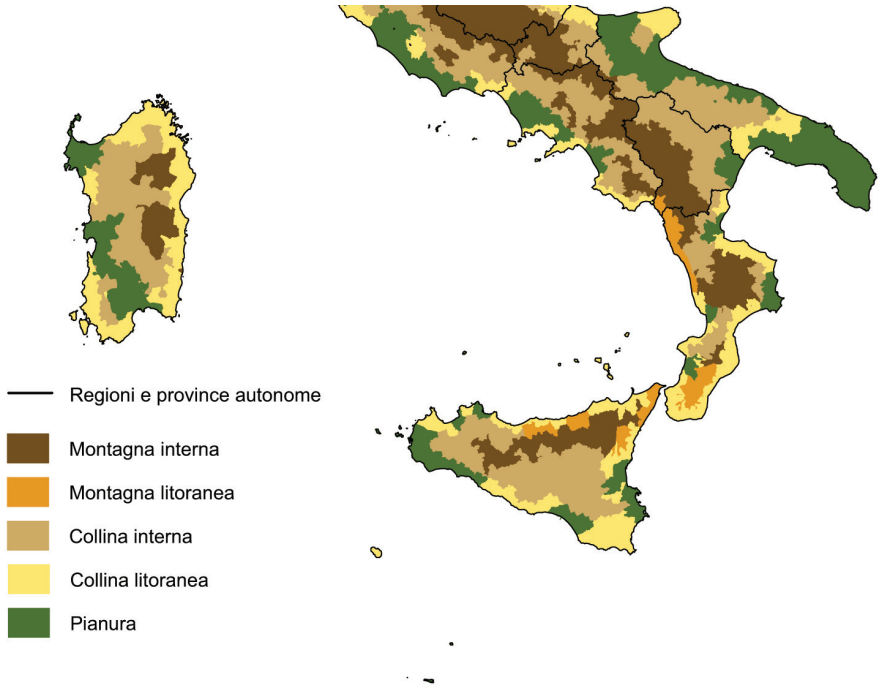

Figure 2. Altitudes in the South of Italy, from: ISTAT (2009)

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References

AA.VV. (1907), I piccoli serbatoi a corona. L'avvenire della irrigazione e i doveri dello stato in Italia, Piacenza, Stabilimento Tipografico Piacentino

AA.VV. (1954), I piccoli serbatoi a corona ed a sbarramento, estratto da "L'Avvenire Agricolo", agosto, Grafica Emiliana

Baldi M.E., Leone M., (a cura di) (2003), Agricoltura e città : una integrazione possibile, Palermo, Arte

Barbera G. (2006), Agricoltura, giardini e paesaggio nella Sicilia islamica, in Atti del Seminario internazionale "giardini Islamici", "Overview" all. al n°16 "Architettura del Paesaggio", Milano, Paysage.

Bellia F. (1960), Diffusibilità dei laghetti collinari in Sicilia, Milano, A. Giuffre

Bellincioni G. (1933), I laghetti artificiali per l'agricoltura, Milano

Bresc H., Di Salvo P., (2002), Macchine ad acqua in Sicilia: i mulini, i paratori, le cartiere, e le altre applicazioni, Palermo, L'Epos

Caruso P. (1967), Studi e ricerche sui laghetti collinari costruiti in Sicilia, in Quaderni di Agronomia n. 4 dell'Istituto di Agronomia Generale e Coltivazioni Erbacee dell'Università degli Studi di Palermo, Palermo, Industria Grafica Nazionale

Ciasca R. (1928), Storia delle bonifiche del Regno di Napoli, Bari

Cornieri E. (1958), In margine ai laghi collinari, Istituto sperimentale per lo studio e la difesa del suolo, Firenze, Tip. B. Coppini e C.

Crivellari G. (1987), Laghetti collinari. Studio – Progettazione – Costruzione, Roma. Ed Agricole

Fierotti G. (1975), La Sicilia e le sue zone irrigue, Quaderni di Agronomia n.8, Istituto di Agronomia Generale e Coltivazioni Erbacee dell'Università degli Studi di Palermo, Palermo, Arti grafiche siciliane

Marangon F. (a cura di) (2006) , Gli interventi paesaggistico-ambientali nelle politiche regionali di sviluppo rurale, Milano, Franco Angeli

Magnaghi A., Marson A. (2005), Un territorio da Lupi. Un commento alla nuova legge urbanistica nazionale e alcune proposte alternative, in Gibelli M.C. (a cura di), La controriforma urbanistica, Alinea, Firenze

Masboungi A. (2002), Penser la ville par le paysage, Paris, Editions de La Villette

Medici G., Massacesi A., Giorgi E., Gasparini M., Cavalli M., Evangelisti G., Cesarini G. (1959), Laghetti collinari, in: "Genio rurale", n.7-8, Bologna, Edizioni Edagricole

Ministero dei Lavori Pubblici, (1934), Le sorgenti italiane: elenco e descrizione, Roma

Sherard J.L. (1992), Embankment dams , Sukhmander Singh NY, American society of civil engineers

Toccolini A. (1987), Urbanistica rurale, Università degli Studi di Milano, Milano, Clesav

Toccolini A. Fumagalli N., Senes G. (2004), Progettare i percorsi verdi, Santarcangelo di Romagna, Maggioli Ed.

Todaro P. (2006), Sistemi di captazione e gestione dell'acqua nella piana di Palermo nel Medioevo, in Atti del Seminario internazionale "giardini Islamici", Palermo 12-14 ottobre 2006 (a c. di G. Barbera), "Overview" allegato al n° 16 di "Architettura del Paesaggio", Milano, Paysage

Zucconi G. (1971), I laghi collinari nell'economia italiana, Trescore B., Editice San Marco

Documents

Piano di Tutela delle Acque in Sicilia, http://www.regione.sicilia.it/arra/piano_acque/piano08_index.htm

Programma di Sviluppo Rurale Sicilia 2007/2013, in: http://www.psrsicilia.it

ISTAT, Atlante di geografia statistica e amministrativa - Edizione 2009

Piano Regolatore Generale Acquedotti, http://gurs.pa.cnr.it/gurs/Gazzette/g06-32o1/g06-32o1-a.pdf

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